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Technological development and nation-building in China: Constructing an innovation-driven economy with Chinese characteristics

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Abstract

The purpose of this study is to evaluate the impact of globalisation and national identity on China's policies to become an innovation-driven economy. It examines the scientific literature concerning theories of technological development, which cluster around two opposing poles: one associated with globalisation and economic liberalism (techno-globalism), and the other with nationalism and protectionism (techno-nationalism). The research examines key literature on China's economic and social development through a constructivist framework to comprehend the defining characteristics that shape the Chinese national identity and its guiding beliefs. A directed content analysis method is used to create a coding scheme with three categories: i. creation of innovation; ii. direction of innovation; and iii. normative framework. This categorisation was applied to the last five Five-Year Plans for National Economic and Social Development (10th to 14th), which cover the period 2001 to 2025. The results of the research reveal that China has consistently adopted a liberal strategy of open market to promote technology transfer and consequent development of national science, technology and innovation (STI) capabilities. However, the analysis does not seem to indicate a broad adoption of the techno-globalist framework either, as this non-isolationist strategy was chosen to boost technological transfer with the goal of achieving autonomy in the long run, enabling China to redefine and construct its national identity as an innovation-driven nation and a global leader. Innovation, therefore, has not only an economic value, but is a fundamental piece of a broader civilisational mission.

Keywords: innovation; national identity; policy; science and technology; China.

1. Introduction

Since its foundation, the People's Republic of China (PRC) has been busy conciliating nationalism, economic development and technological progress. China under Mao had as its goal to modernize the country under Marxist principles: the internationalization of class warfare, anti-capitalism and anti-imperialism. The post-Maoist reforms of Deng Xiaoping, however, had to redefine the national identity under more nationalist terms, as a traditional communist doctrine would be incompatible with economic development under a market

economy. More recently, as China further develops and tries to assert its new position as a global leader, a new and seemingly contradictory shift is taking place, with Chinese president Xi Jinping trying to combine Chinese nationalism and economic growth with a traditionalist discourse of recommitment to Maoist principles which are, by definition, anti-nationalist and anti-capitalist (Wang, 2017).

The role of science, technology and innovation (STI) has also been highlighted by president Xi Jinping as fundamental to achieve China's prosperity and rejuvenation. In 2018, during his speech at the 19th Academician Meeting of the Chinese Academy of Sciences, Chinese president Xi Jinping highlighted the importance of self-reliance and independent innovation as the only way to reach the peak of technological development (Xi, 2018).

Indeed, some notable studies have been made on the relation between nationalism and technological development in the catching-up experience of China. A 2013 study by Andrew B. Kennedy on the Renewable Energy in China has revealed that, following unsuccessful policies to promote technological transfer from the opening to foreign direct investment in the early 1990's, China's 2006–2020 Medium and Long Range S&T Plan (MLP) initiated a pragmatic techno-nationalism approach, which, according to the author, was fundamental to the development of the Chinese technological capabilities in that industry. As the MLP stated, "[F]acts have proved that, in areas critical to the national economy and security, core technologies cannot be purchased" (China, 2005, II.1 Guiding principles). This experience is in line with the National Systems of Innovation (NSI) approach, that technology transfer is not an automatic process. Kennedy (2013) concluded that, while China seemingly broke the World Trade Organization (WTO) principles by providing protection and subsidies for their local companies, the protectionism paid off: If in 2004 three quarters of all wind turbines installed in China were foreign-made, by 2010, Chinese companies controlled 85% of the market (p. 921).

However, as the author noted, it did not mean that China's STI policy during the 2000's was autarkic, as the MLP also revealed that there was not enough confidence on the domestic capabilities of China at the time, so the document highlighted the importance of technological cooperation for the country. Indeed, the author's key argument was that China pursued a pragmatic approach towards techno-nationalism which saw international cooperation as fundamental for China to improve its technical expertise.

This seemingly contradictory discourse combining self-sufficiency with collaboration has not been lost: In the same 2018 speech, president Xi still highlighted the importance of cooperating with the international community to further national science and technology and actively participate in and lead international scientific plans and projects (Xi, 2018). A keyword in this discourse reveals a major difference between the previous catching-up phase and the current moment: "lead". With this in mind, the guiding question that this research will try to answer is "How has nationalism been defining the STI strategies to transform China into an innovation-driven economy?". To answer such question, it is required an analysis that goes beyond the traditional rhetoric on nationalism, trying instead to understand the particularities and historical context in which modern Chinese nationalism has developed and its effects on both policy and individuals. Furthermore, the results of this research should help

to better understand what could be expected from the Chinese domestic and foreign policy regarding STI, and potentially provide policy insights that could be localized to other emerging nations in the Global South.

2. Theoretical background

Intellectuals have been quite nationalist about science and technology in nearly every nation, as national characteristics have been shaped by technology (Edgerton, 2007, p. 2). Robert Reich, in 1987, has called this nation-centric approach towards technological development techno-nationalism. According to him, techno-nationalism is an ideology that emphasizes the promotion of independent national technological and scientific development as a means of gaining competitive leverage in economic and military competition with other nations. Since STI are fundamental determinants for national prosperity and security, nascent industries should be protected from global competition. Akin to a sort of technological mercantilism, the inflow of innovations should be promoted and directed towards building national technological capabilities, while the outflow of technologies must be controlled (Reich, 1987, as cited in Li, 1994, p. 2)

Since then, many authors have built upon this idea, while still sharing the same principle that “nation-states [are] engaged in a competitive struggle in which technological prowess is crucial” (Kennedy, 2013, p. 912). Arguably, the most influential work on techno-nationalism has been Richard Samuels’ seminal work "Rich Nation, Strong Army": National Security and the Technological Transformation of Japan. Samuels explains techno-nationalism as the as the belief that “technology is a fundamental element in national security, that it must be indigenized, diffused, and nurtured in order to make a nation rich and strong” (Samuels, 1996, p. 33). As a development strategy, techno-nationalism argues that self-sufficiency needs be achieved through the exploitation of imported technology, allowing a nation to gradually evolve from learning and imitating to eventually developing their own autonomous technology capabilities (Bitzinger, 2015, p. 458).

Others would be less inclined to see technology as the focus of international competition and more likely to perceive opportunities for international collaboration. Nakayama (2012) goes a step further, criticizing the techno-nationalistic ideology as a hindrance to real development. For him, “as countries developed their own technology for their own sake [during the Cold War period], the technology gap and differences in the standard of living seemed as if they would continue to widen” (p. 14). The usual way for developing countries to industrialize is to take advantage of their cheap labor to manufacture products and export to wealthier markets. Since multinational corporations invest their capital seeking cheap labor and low regulations, it is preferable for governments to adopt pro-globalization policies to encourage foreign direct investment (FDI) and potential transnational technology transfers between foreign and local staff. The techno-globalization trend, the author concludes, is set to reverse the technology gap and promote further equality among nations; thus negating assertions such as those made by the dependency theory (pp. 13-14).

The rejection of the "old" values of nationalism and state-interests was accelerated by the drastic transformations on global affairs that started in the 1990's. According to Ostry and Nelson (1995), the concept of techno-globalism was first coined during the 1980s and denotes a production strategy where multinational enterprises (MNEs) take advantage of their technological edge to penetrate foreign markets, while also acquiring and creation new technologies through a network of global technological collaboration (p. 24). In other words, the overall techno-globalist ideology is based on the premise that – in a world of MNEs and FDI – trade should be liberalized in order to integrate developing nations in the global value chains. By investing in a foreign market, MNEs could provide resources, know-how and technologies which might otherwise not be present in the receiving country, thus promoting a spill-over effect on the local economy. China is often quoted as the exemplary case of a country that benefited from such integration, which enabled it to become the "world's factory".

From the perspective of developing countries, technology acquisition is still part of a techno-globalist development strategy. But rather than treated as a first step to address a strategic national technological gap; techno-globalists understand technology acquisition as a continuous learning process that occurs naturally between firms through technology transfer mechanisms. State intervention is usually limited to providing public goods and services, such as educating the workforce. Public R&D, if needed, is usually limited to basic research only, while applied research related to products or processes is kept to the private sector (Keller & Samuels, 2003, p. 11). Notably, there is no overarching political strategy for technological autonomy, as interdependence is seen as a benign aspect of a globalized world.

Nonetheless, while these mechanisms for technology transfer can provide benefits to both MNE and host country, they also have explicit and implicit costs. Technological development requires considerable investments, so businesses are keen to protect their intellectual properties. Furthermore, developing countries are constantly competing to receive and retain the investments of these MNE, which could promote a sort of 'race to the bottom' with concessions and deregulation: "It has been noted that when the bargaining power of recipients was weak, the inclusion of export restriction clauses and tie in clauses on purchases tended to be the rule" (Chesnais, 2010, pp. 265-266).

3. Methodology

Most of reviewed literature tried to explain China's policymaking based on 'rational actor' model, which assumes that a state pragmatically calculates how to maximize its relative or absolute power. However, these methodologies could also be a potential limitation for most mainstream International Relations theories: They attempt to be universalist by design, yet they often end up explaining the world through the lens of Western experiences and values. History is not ignored by these theories; but it is treated as natural laboratories of atomized case-studies to test their theories. The prescriptions, nonetheless, are ahistorical. They propose that policy calculations are mostly utilitarian, and states with similar capabilities, as rational actors, would act according to similar instincts and interests.

It should be recognized that the role of institutions – such as laws, national identity and culture – is a fundamental part of the policymaking process. The perception of national identity and interests can vary quite a lot in time and space, and knowledge and technology themselves have a role at influencing the thinking of a society, as claimed by the philosophy of technology (Kaplan, 2009). At an individual-level, Chinese policymakers and businessmen alike are heavily influenced by their national identity. That is not to say that they necessarily pursue nationalist policies, but national identity and history should be a part of any substantive analysis exploring the influence of nationalism in China's technological development.

In this regard, constructivist theory seems to be the most suitable theoretical framework to analyze the subjectivity of agents, offering tools to understand the perception of national values and sense of belonging of a country's population. Rather than attempting to assess causal relations between variables and test hypotheses, constructivism aims to explain the motivations underling the actions of an international actor. Therefore, following the constructivist framework, this research will use an interpretivist, qualitative methodology, with the directed content analysis method as proposed by Hsieh & Shannon (2005).

As previously stated, China has introduced a wide range of sector-specific and technology-specific policies and analyzing all of them would be rather impossible in the time frame of this project. However, China's 5-year plans can provide an overarching roadmap of the Chinese strategy towards technological development, from the catch-up phases of the early 2000's to the mastering of frontier technologies in multiple key-sectors. The documents are also insightful windows to contemporary Chinese ideology and the perception of itself and its role in global affairs.

Once the specificities of Chinese nationalism have been understood, the policy documents can then be analyzed through a deductive category application based on the Constructivist Theory, as it "can provide predictions about the variables of interest or about the relationships among variables, thus helping to determine the initial coding scheme or relationships between codes" (Hsieh & Shannon, 2005, p. 1281). Based on this methodology and the literature review, the three categories below describe a meaningful coding scheme to be applied to the key national policies guiding China's development strategy, namely the China's Five-Year Plans for National Economic and Social Development.

Creation of STI: This category looks at mechanism to promote the development of STI from the supply side and the main actors responsible for it. A techno-nationalist framing would be identified by an emphasis on independent development by national research institutions and national firms, indigenization of technologies from abroad, state activism and overall national responsibility of STI development. Techno-globalists would not be concerned about the nationality of STI, and as such, acquiring technologies from abroad thought FDI or international cooperation is equally acceptable. Furthermore, techno-globalism does not perceive technology as a strategic commodity that requires security, so technical assistance and STI outflows is also permissible.

Direction of STI: This category looks at the demand side of things and where are the developments of STI being directed towards. Techno-nationalism assesses that technology has a strategic role in raising the national capabilities in the international sphere. Therefore, STI is directed towards strengthening national industries in multiple sectors (even if they are not as efficient as simply importing goods), national consumption, military and dual-use applications, and broad scientific development applied to non-economic fields ("innovation for its own sale"). Techno-globalism also directs STI development towards improving productivity, but with a clear prioritization towards strengthening the comparative advantages of the country (rather than artificially creating new capabilities) and to fulfill the demands of global markets. Techno-globalism has also bene described as sensitive to use STI to address global issues such as climate change and international development.

Normative framework: This category looks at the background conditions of the national innovation system that influence the creation and application of STI in the country, such as regulations, technical standards, culture and governance of STI. Techno-nationalism encourages national coordination of efforts based on cultural and patriotic interests; regulations to protect and nurture national technological capabilities, such as import restrictions; and explicit and implicit norms that turn difficult the entrance of foreign actors. The normative framework of techno-globalism is pro-market and advocates for liberalization, equal treatment for foreign and national companies, cosmopolitanism, and respect to social and environmental causes based on international norms.

By applying this analytical framework, it will be possible to transform qualitative data into codable units and categories schemes. These codes will be used to analyze deductively the relevant source materials. This can be further developed into simpler forms of numeric representations of data for frequency analysis or other basic descriptive analysis. The main benefit brought by this technique is that it enables the concomitant analysis of each plan from both perspectives. Since these documents are comprehensive national development plans, they are bound to have characteristics of both ideological frameworks. By creating codable units of ideas, it is possible to overcome ambiguity by focusing on the frequency of specific codes to determine if said documents are indeed influenced by techno-nationalist ideologies or if they are more neutral or techno-globalist in nature.

4. Analysis

4.1 Creation of Innovation

A key summary of the defining characteristics of each plan in terms of the creation of innovation are as follows:

Table 1: Comparative code frequency of approaches regarding the creation of innovation (2001-2025)

		Codes and frequencies per plan									
		10th Five-Year Plan (2001-2005)		**11th Five-Year Plan (2006-2010)**		**12th Five-Year Plan (2001-2015)**		**13th Five-Year Plan (2016-2020)**		**14th Five-Year Plan (2021-2025)**	
Approach	**Techno-Globalism**	5	42%	11	31%	4	44%	30	56%	8	38%
	Techno-Nationalism	7	58%	24	69%	5	56%	24	44%	13	62%

10th Five-Year Plan (2001-2005): The creation of innovation is explicitly linked to the opening of China to the outside world. It adopts pragmatic techno-nationalism, which acknowledges the crucial role of transnational companies, but that industrial capabilities should be built in national territory.

11th Five-Year Plan (2006-2010): Emphasis on the need for independent creation of innovation in nearly all fields. Guide foreign capitals to be invested in high tech industry, and domestic enterprises to conduct multi-form cooperation with transnational companies and exert the technology spill-over effect of foreign capitals.

12th Five-Year Plan (2011-2015): Adopts indigenous innovation as a principle of Chinese economic development, indicating the transition of China towards identifying itself as an innovative-type country.

13th Five-Year Plan (2016-2020): Embraces the idea of becoming an innovation-driven economy. Chinese companies to become central actors for economic development, taking a leading role in market-oriented S&T programs, domestically and abroad. More attention is given to make China a leader in international STI development, which also includes frontier technologies and service sector.

14th Five-Year Plan (2021-2025): Sinicization of research efforts. Orientation towards the world's cutting edge in S&T, while promoting self-reliance and self-improvement as strategic support for national development. Advocates for support for international knowledge exchanges, the establishment of international STI organizations within China and opening of the national S&T programs.

4.2 Direction of Innovation

A key summary of the defining characteristics of each plan in terms of the direction of innovation are as follows:

Table 2: Comparative code frequency of approaches regarding the direction of innovation (2001-2025)

		Codes and frequencies per plan									
		10th Five-Year Plan (2001-2005)		**11th Five-Year Plan (2006-2010)**		**12th Five-Year Plan (2001-2015)**		**13th Five-Year Plan (2016-2020)**		**14th Five-Year Plan (2021-2025)**	
Approach	**Techno-Globalism**	11	52%	9	32%	10	56%	13	42%	9	33%
	Techno-Nationalism	10	48%	19	68%	8	44%	18	58%	18	67%

10th Five-Year Plan (2001-2005): Innovation to be applied to improve national productivity, but still in the context of an export-oriented economy without much attention to more political and strategic uses.

11th Five-Year Plan (2006-2010): Independent innovation capabilities directed towards reducing technological dependence in virtually all fields. Need to fulfil not only the external demand by foreign multinationals, but also through independent Chinese enterprises and brands.

12th Five-Year Plan (2011-2015): Innovation directed towards placing China in a high ground in future sci-tech competition. Stronger push to apply innovation towards environmental objectives.

13th Five-Year Plan (2016-2020): Efforts are made to deepen China's integration to global markets, but with explicit intention of boosting China's leadership role in multiple sectors. Innovation is not only directed towards industrialization, but it also becomes a product on itself. STI directed towards fulfilling both domestic and foreign demand to nurture new drivers of economic growth.

14th Five-Year Plan (2021-2025): deeper civilizational role to technological development, STI gets directed towards creating the future of China. Cultivation of new types of national consumption is encouraged.

4.3 Normative Framework

A key summary of the defining characteristics of each plan in terms of the normative framework are as follows:

Table 3: Comparative code frequency of approaches regarding the normative framework (2001-2025)

		Codes and frequencies per plan									
		10th Five-Year Plan (2001-2005)		**11th Five-Year Plan (2006-2010)**		**12th Five-Year Plan (2001-2015)**		**13th Five-Year Plan (2016-2020)**		**14th Five-Year Plan (2021-2025)**	
Approach	**Techno-Globalism**	12	67%	8	36%	11	85%	25	63%	12	60%
	Techno-Nationalism	6	33%	14	64%	2	15%	15	38%	8	40%

10th Five-Year Plan (2001-2005): Emphasis on market reforms to create more competitive environment, reflecting the China's commitment with the WTO. Calls for form of state-owned enterprises to enable them to compete as equals in the market economy. Encourage more participation by all elements of society in the policy priority-setting.

*11th Five-Year Plan (2006-2010):*Nationalism explicitly embedded in the national innovation system through basic education and cultural industry. Guide foreign merchants to participate in the restructuring and innovation of domestic enterprises on the basis of protecting domestic independent brand.

12th Five-Year Plan (2011-2015): Expands the principle of market orientation, enterprises' independent decision-making and the separation between government and non-government functions. Ambitious standards for laws, regulations, and standardization systems on environmental protection. Emphasis on the socialist framework which is intertwined with national identity.

13th Five-Year Plan (2016-2020): Policies to promote opening-up, remove institutional barriers and align national industries with international standards. Private sector to have the leading role in promoting innovation-driven development.

14th Five-Year Plan (2021-2025): Opening up of the service industry to the outside, further relax market access, and comprehensively clean up unreasonable restrictions. Explicit message of ethnic unification and, forge a strong community consciousness of the Chinese nation. Establish an online Chinese civilization.

5. Discussion

Throughout the two decades since the publication of the 10th plan, the centrality of innovation has grown substantially to China, to the point that is now a pillar of the 14th plan. The recognition of the importance of STI by Chinese policymakers seems not only to grow but to shift qualitatively. It begins as a major tool for economic development, with foreign investment, global trade and technology transfer being useful. But particularly in the later plans, the concept of innovation becomes ubiquitous and is hallowed as a panacea for all problems, from crime prevention and control to environmental issues. Innovation becomes a prized value and virtue that Government explicitly disseminates among society and advocates as something that not only all governmental organizations and private entities shall practice, but also every citizen. China wants every individual to help forge an innovative society and innovation to become part of the spirit of its people, part of the defining beliefs of Chinese socialism.

To this end, China adopts a strategy of strong government intervention to promote STI, deregulation to allow for private-led transactions, intensification of trade and research network with the world, attraction of foreign direct investment and strengthening of key, STI-intensive sectors (like military weaponry and telecommunications). Yet, China's plans were always incorporated in the international context, so there is no evidence of it being autarkic or isolationist. It is a techno-globalist strategy to attend techno-nationalist ends.

The connection between national values, identities and aspirations in the country's policies towards the development of an innovation-driven economy becomes evident by the 12th plan and it is made explicit in the 14th plan, which guides the potential of STI to the creation of an advanced, digital and prosperous nation. The plans reflect the government's intention of heading a socialist country that operates on a capitalist economic structure – or, on a metaphor, running the software for a "spiritually socialist civilization" on a liberal market hardware. The place for each is delimited: there's a space for capitalism, which is the space of economy, of social creation and exchange of values, including jobs; and there's the space of socialism with Chinese characteristics, the space of knowledge, of political acts and the mind of all citizens. The result is a powerful centralized government with strong social-welfare policies running on a liberalized market-economy.

To China, reform and opening up to the world did not mean accepting the extremely techno-globalist position that, in an open market, there is no need for countries to pursue technological independence; it is a way of achieving it. China has clearly abandoned the isolationist approach long ago and it does not seem to intend to turn back. It seems to wish to stay integrated in the global network, for it helps the country's interests. That doesn't mean autonomy lost its relevancy: it has always been central.

Still, the theoretical frameworks do not fully explain Chinese technological development as its unique blend of socialism and nationalism does not always fit in the realist vs liberalist worldview. The growing commitment towards internationalization may not be simply attributed to pragmatism, as it has been an ideological commitment since the very formation of the PRC. The same could also be said about China's impetus towards social development,

sustainability and equality under the guiding terms of its socialist ideology. Additional research is needed to further understand if China's techno-globalist policies for technological development can be attributed to political pragmatism and rational choice calculations (following mainstream Realism and Liberalism theories), adaptation to international norms, or a genuine commitment to building its unique Chinese socialist spiritual civilization.

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